



## **CALTRANS SUBREGIONAL OPERATIONS FORUMS**

**Performance Management**





# What We're Talking About

- ▶ What gets measured gets done....
  - ↳ ...but also, You get what you measure.
- ▶ Why is performance measurement important?  
(funding, program management, improve practices and operations, manage staff)
- ▶ Performance measure process
  - ↳ Identify key elements – connect vision and goals to the measures and data.
- ▶ Local efforts and tools to support performance analysis





# Why Do Performance Measurement?

- ▶ We were told we had to ...

- ↳ Legislative mandate or agency initiative
- ↳ Funding increase proposal

*....But it might be just good idea!*

- ▶ Accountability and transparency

- ↳ Decision makers, the public, our bosses
- ↳ What did we produce with their money?

- ▶ Proactive public relations for the agency

- ↳ Maintain visibility of transportation
- ↳ Data + Analysis + Communication = Credibility



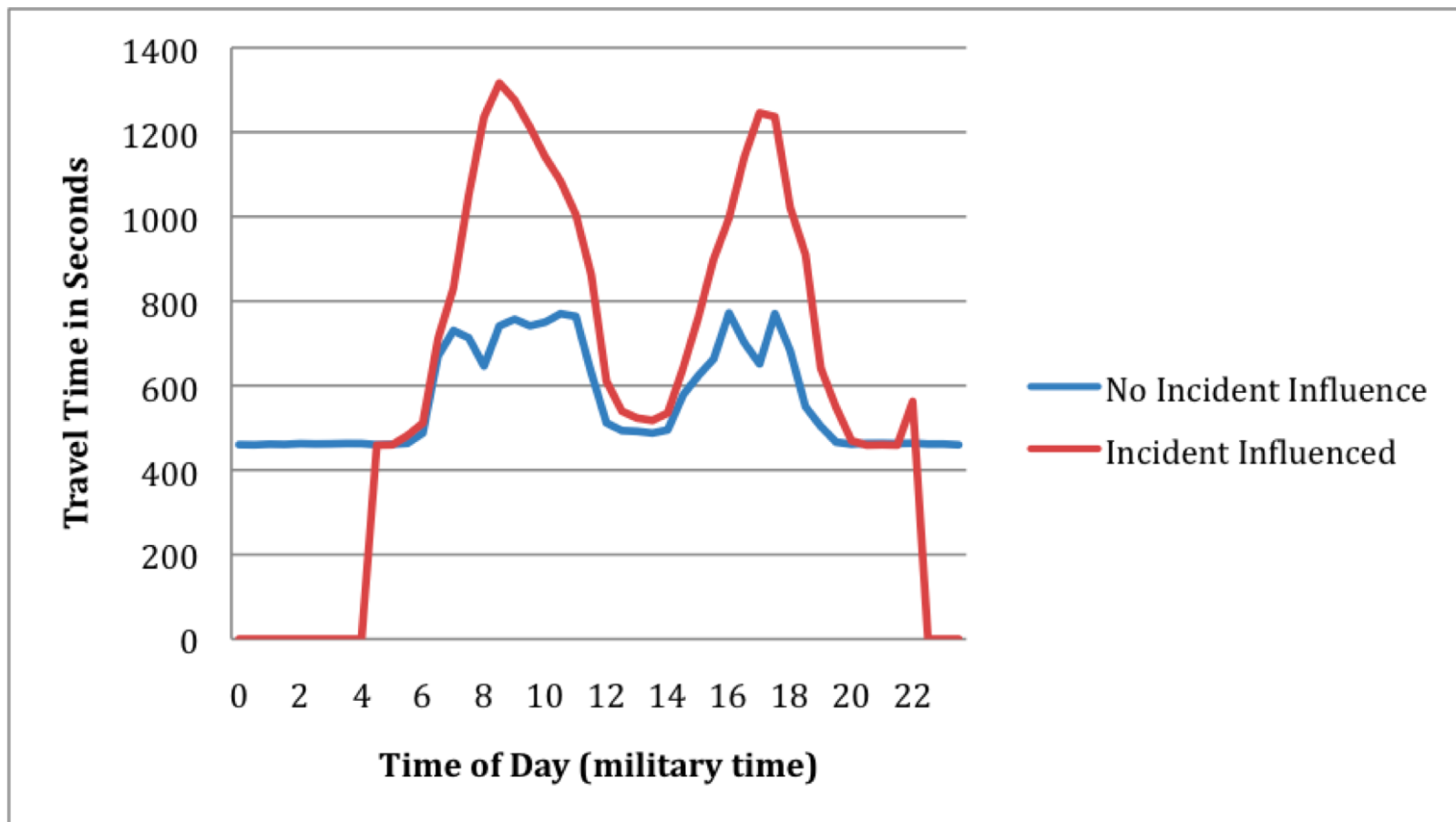
# Why Do Performance Measurement? (Internal Story)

- ▶ How will we get better? How do we compare?
- ▶ Allows operations to compete in idea marketplace
- ▶ Similar to other data intensive programs
- ▶ Tell a good story for budget justification
  - ↳ % of pavements in Good or better
  - ↳ # of structurally deficient bridges
  - ↳ # of operating dynamic message signs....detectors  
...signals...
- ▶ Inform operations priorities





# The Operations Goal: *Can I Make Every Day Averagely Bad?*





# A Few Key Principles for Performance Monitoring

4D View	Style	Time	Data
<ul style="list-style-type: none"> <li>Four dimensions of mobility/congestion should be tracked:</li> <li>Time, Location, Source</li> <li>And the change in any of these – Reliability</li> </ul>	<ul style="list-style-type: none"> <li>Use graphics that resonate with a variety of technical and nontechnical audiences.</li> </ul>	<ul style="list-style-type: none"> <li>Continuity across applications and time horizons;</li> <li>Use the same performance measures for trend monitoring, project design, forecasting, and evaluations.</li> </ul>	<ul style="list-style-type: none"> <li>Data collected for purposes other than performance measures is almost always better.</li> </ul>

*Source: NCHRP Guide to Effective Freeway Performance Measurement*





# What are some Examples of Transportation System Performance Measures?





# Types of Measures

## Outcome

- ▶ Safety
- ▶ Delay
- ▶ Reliability
- ▶ Incident response
- ▶ Incident duration
- ▶ Mode shift
- ▶ Person throughput
- ▶ Cost savings

## Activity (output)

- ▶ Traffic volumes
- ▶ Person/vehicle throughput
- ▶ 511 calls
- ▶ Web site visits
- ▶ Incident clearance time
- ▶ Number of trainings attended
- ▶ Number of projects brought in on schedule
- ▶ Quantity of ITS devices



# MAP-21 Staged Rulemaking

NPRM DATE	MEASURE CATEGORY
<b>STATUS I</b> <b>NPRM 1Q '14</b> <b>Final 1Q '16</b>	✓ Serious Injuries per VMT
	✓ Fatalities per VMT
	✓ Number of Serious Injuries
	✓ Number of Fatalities
<b>STATUS II</b> <b>NPRM 1Q '15</b> <b>Final 2Q '16</b>	✓ Pavement Condition on the Interstates
	✓ Pavement Condition on the Non-Interstate NHS
	✓ Bridge Condition on NHS
<b>STATUS III</b> <b>NPRM 1Q '16</b> <b>Final ?</b>	• Traffic Congestion
	• On-road mobile source emissions
	• Freight Movement
	• Performance of Interstate System
	• Performance of Non-Interstate NHS

Then, effective date, targets and reporting.



# But what about other important measures?

- ▶ Work zones
- ▶ Planned special events
- ▶ Responses to weather conditions
- ▶ Traffic incidents (don't these contribute to reliability?)



# How are agencies here responding to MAP-21 requirements?





# Travel Time (*Quality*)

- ▶ The average time required to traverse a section of roadway in a single direction
  - ↳ Urban Freeways: 2 to 5 miles or between interchanges
  - ↳ Signalized Roads: 0.5 to 2 miles or between intersections with major roads
- ▶ Measurement
  - ↳ Direct: probe vehicle-based, smartphones, fleets
  - ↳ Indirect: detector-based

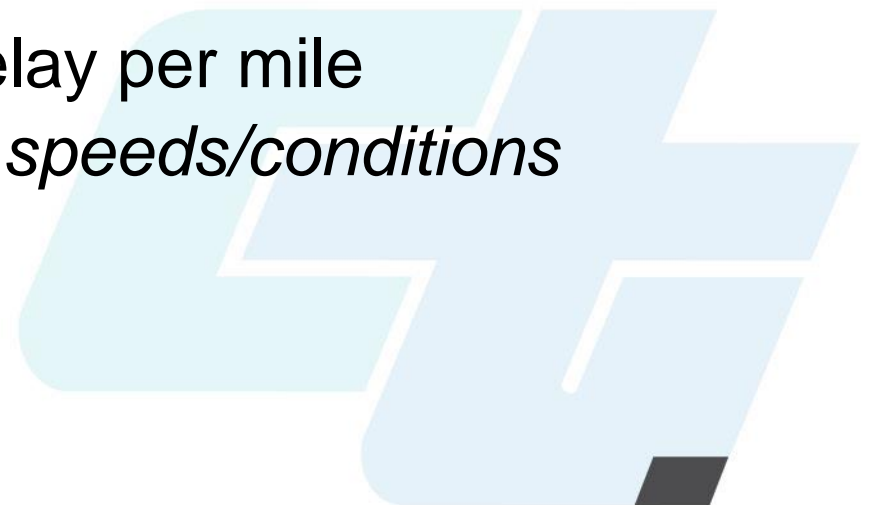
<http://www.wsdot.wa.gov/accountability/>





# Total Delay (*Quality*)

- ▶ Total delay (measured across entire year)
  - ↳ Recurring - Vehicle delays that are repeatable
  - ↳ Non-recurring or Event – Unusual delays
- ▶ Difference between the travel time for a roadway segment and the unconstrained travel time
  - ↳ Vehicle-hours and person-hours
  - ↳ For multiple corridors – delay per mile
  - ↳ *Can also use other target speeds/conditions*





# Throughput (*Quality*)

- ▶ Person: People flow on all roadway types under both recurring and nonrecurring traffic conditions (persons/hour)
- ▶ Vehicle: Traffic flow on all roadway types under both recurring and nonrecurring traffic conditions (vehicles/hour)
- ▶ Vehicle-miles of travel (VMT) often used as a throughput measure as well; also an important weighting factor for all measures



# Travel Time Index (*Quality*)

- ▶ Normalized comparison of travel time (so, no length)
- ▶ The average time to traverse a section of roadway in a single direction compared to free-flow travel time
  - ↳ Urban Freeways: 2-5 miles or between interchanges
  - ↳ Signalized Roads: 0.5-2 miles or between intersections with major roads
- ▶ Measurement
  - ↳ Direct: probe vehicle-based
  - ↳ Indirect: detector-based

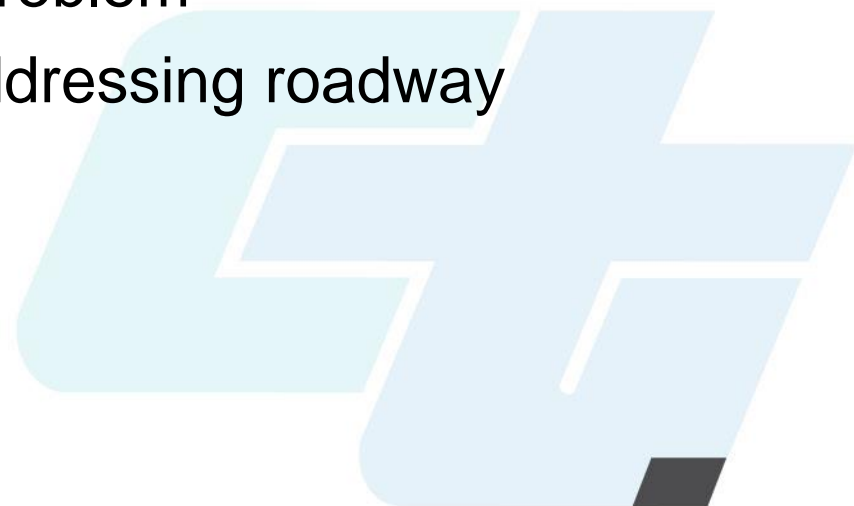
[http://www.grta.org/tran\\_map/2010\\_Transportation\\_MAP\\_Report.pdf](http://www.grta.org/tran_map/2010_Transportation_MAP_Report.pdf)





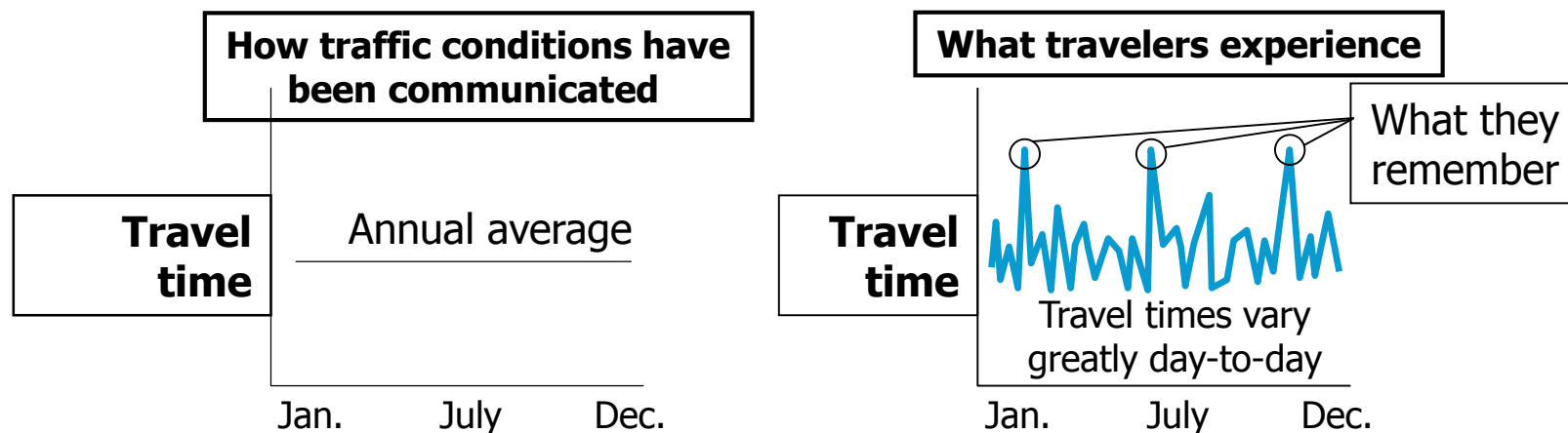
# Why Is Reliability Important?

- ▶ Less tolerance for unexpected delay
- ▶ Planning for unreliable travel has costs for users – late & early arrivals!
- ▶ Economic competitiveness
- ▶ Valued service in other utilities & industries
- ▶ This is how we can “solve the problem”
- ▶ Can be treated effectively by addressing roadway “events”





# Averages Don't Tell the Full Story



**When MnDOT's ramp meters were turned off in 2000:**



22 percent  
worse  
average travel  
times



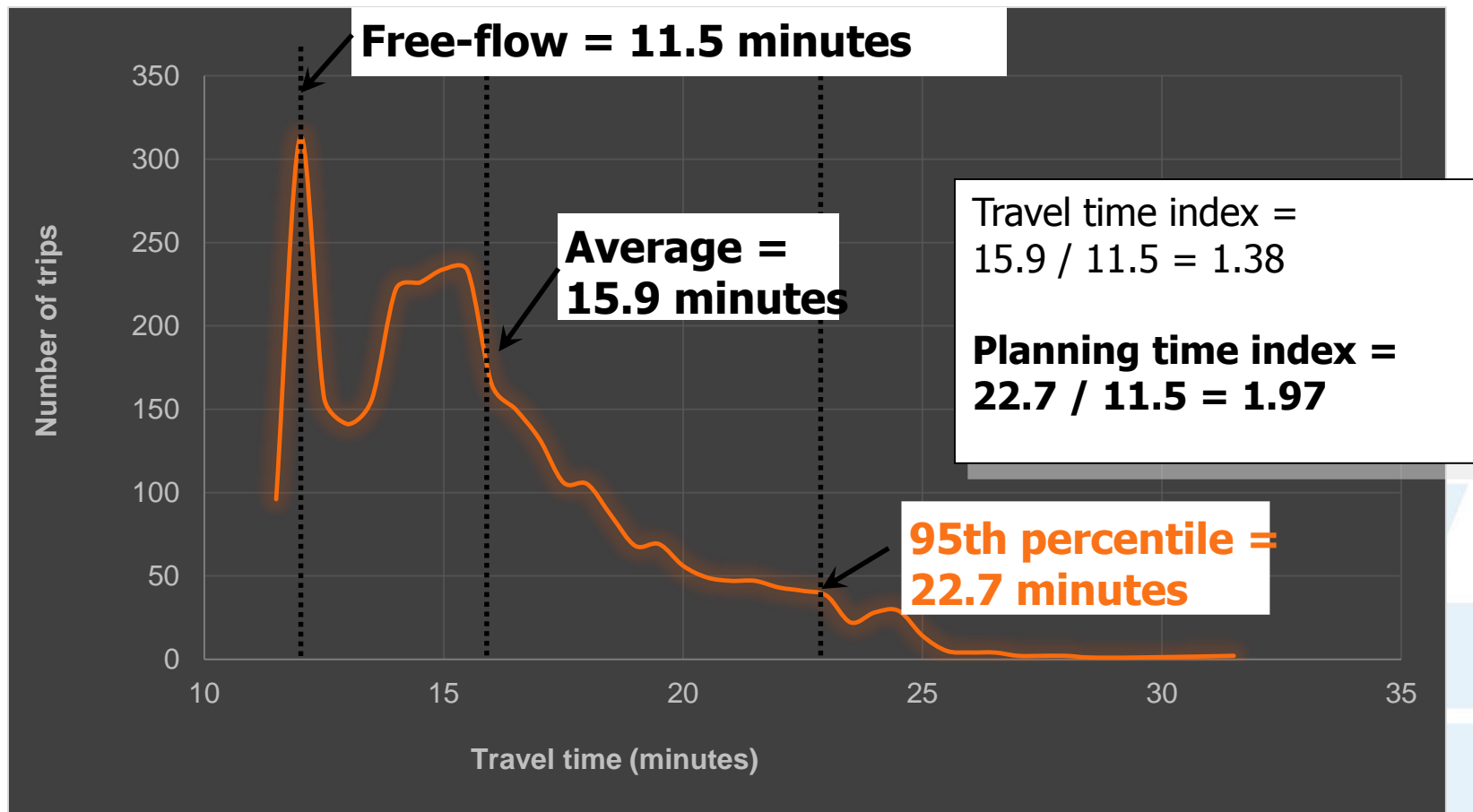
91 percent  
worse  
travel time  
reliability



# Travel Time Reliability: *The Operations Story*

- ▶ Measured by how travel time for a trip varies from day to day
- ▶ The variability in travel times
  - ↳ “How long will my trip take today compared to the same trip at the same time on any average day?”  
... this implies ...
  - ↳ Travelers have the ability to predict travel time for a trip and to arrive at destination within an “on-time window”
  - ↳ Does not include driver-to-driver variation

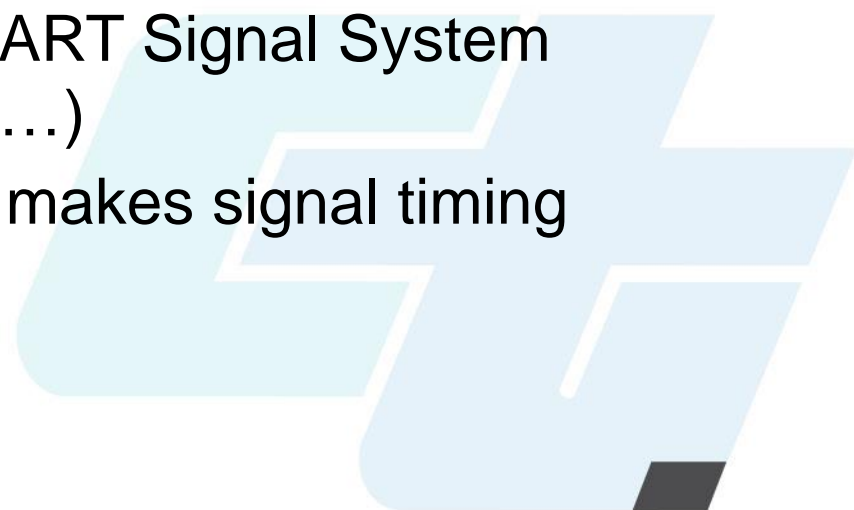
# Reliability Measures Illustrated (On the Barnes & Noble Magazine Rack)





# Arterial/Signal System Measures (*Activity & Quality*)

- ▶ Useful Measures for Arterials and Signal Systems:
  - ↳ Travel Time, Delay, Queue Length, Split Failure, Cycle Failure, Stops, Emissions
- ▶ Research findings:
  - ↳ Purdue: Bluetooth; signal phase and timing information
  - ↳ NCHRP 3-79: Travel times on arterials
  - ↳ University of Minnesota: SMART Signal System
  - ↳ Others (Oregon, Univ of MD...)
- ▶ Ability to visualize performance makes signal timing evaluation less complicated







# Incident Management Measures (*Activity & Quality*)

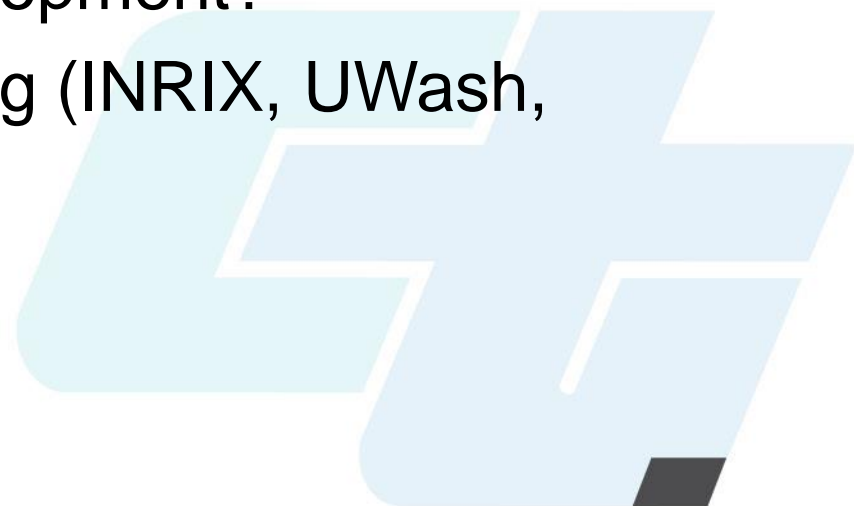
- ▶ Agency operations are most common performance measures (why??)
- ▶ Describe the services performed & *outcomes*
  - ↳ Service patrol vehicles per mile or hours of service provided - most frequent
  - ↳ Location, number and timing of incidents
  - ↳ *Public wants to know >>>> Crashes, delay, travel time reliability*





# Freight Measures (*Quality*)

- ▶ Freight Significant Corridors (FHWA)
  - ↳ Partner with ATRI
  - ↳ Average operating speeds (entire Corridor)
  - ↳ Travel time reliability (Buffer Index)
- ▶ Freight throughput
- ▶ Aligning with economic development?
- ▶ Other freight data sets coming (INRIX, UWash, CFIRE)

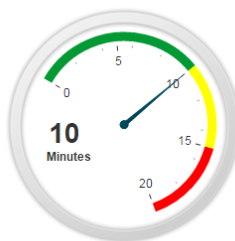




## ▶ GDOT HERO Incident Response Times

## ▶ Explaining Agency Performance

### Average HERO Response Time



#### Description

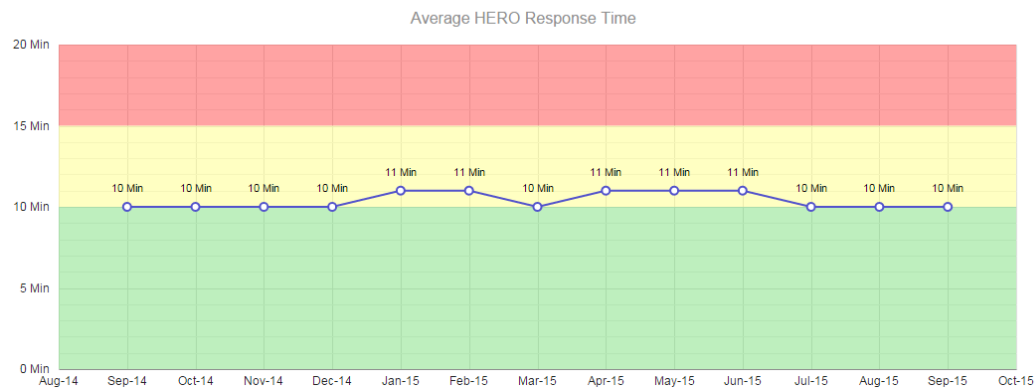
A roadway incident can delay traffic and present a hazard to travelers. By clearing a blocked lane one minute sooner, we could save our traveling public 4 to 6 minutes of delay. This measure tracks the time it takes a HERO unit to reach the scene from the time of notification.

#### Strategic Objective

Reduce the time that the traveling public is impeded by incidents. The target is to reduce incident response time to 10 minutes or less.

#### Road to Improvement

GDOT is exploring options to add additional HEROs to corridors with the highest incident rates. In addition, the new Automated Location and Dispatch System (ALADS) allows operators at the TMC to see the exact HERO truck locations on a map. This helps ensure that the closest HERO is dispatched to an incident, thereby further reducing response times. The average response time for FY 2014 was 13 minutes.



# WSDOT's *Gray Notebook*

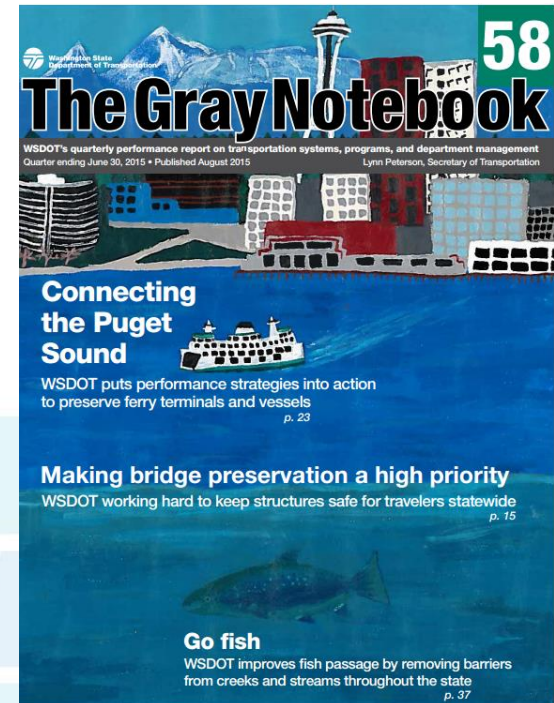
## ► WSDOT's Strategic Approach since April 2001

- ↳ Accountability & Transparency
- ↳ Comprehensive Performance Analysis and Reporting
- ↳ Adaptive and Dynamic Performance Measurement

## ► Communicating Two Simple Themes:

- ↳ Accountability
- ↳ Project Delivery

<http://www.wsdot.wa.gov/accountability/>





# Wisconsin DOT

- ▶ Reliability and Delay Report
- ▶ Part of Five Key Goals for the Department
- ▶ Efficiency, cost, and trending improvements
- ▶ Delay, Reliability, Incident Response
- ▶ <http://wisconsindot.gov/Pages/about-wisdot/performance/mapss/goalmobility.aspx>

## Wisconsin Department of Transportation Travel Time Reliability and Delay Report

Fall 2015



### Travel Time Reliability

The Wisconsin Department of Transportation wants travelers to arrive safely and on-time at their destinations. Having a high level of confidence and certainty of on-time arrival are measures of the reliability of the transportation system.

### How do we measure travel reliability?

**GOAL:**  
Improve the reliability of highway travel

Because system reliability is important to so many individuals and businesses, WisDOT developed a travel time reliability performance measure as part of its MAPSS Performance Improvement Program. The statewide travel time reliability performance (PTI) measure: tracks the reliability of ten Interstate corridors and 28 urban freeway and highway segments. This provides a precise way to budget travel time and measure system performance.

### Planning Time Index (PTI) value

**1.0-1.30** reliable  
**1.31-1.80** moderately unreliable  
**1.81-3.0** unreliable

To calculate reliability, the department developed a Planning Time Index that gives a numerical value for travel reliability.

WisDOT tracks ten Interstate corridors and 28 urban freeway and highway segments

### Sample travel scenario

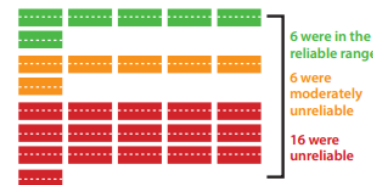
**20 minutes**  
**x 1.5 PTI**  
**= 30 minutes**

A PTI of 1.5 means travel is moderately unreliable. A traveler going for a 20 minute trip during a peak period would be assured of completing the trip in 30 minutes or less at least 95 percent of the time.



### 2014 Fall Quarter

For 28 urban freeway and highway segments:



### 2015 Fall Quarter

For 28 urban freeway and highway segments:



### Efforts to improve

Many things can adversely affect travel time reliability, including traffic incidents, weather, special events, holiday traffic and work zones. Reducing or mitigating the impact of these factors serves to improve travel time reliability. The department is working to improve traffic signal systems, ramp meters, maintenance and work zone management to reduce traffic congestion. As part of the Zoo Interchange reconstruction in southeast Wisconsin, an integrated corridor management system is in place to improve traffic flow during construction. Travelers can also get real-time traffic information from the 511 Traveler Information System and choose to avoid congested routes. Some travelers are willing to accept delay as long as reliable information is available about the length of the delay.



# Houston SAFEClear Rapid Towing Response

- ▶ Response time holds towing companies responsible (90% within 6 minutes)
- ▶ Clearance time & crash reduction used to justify City expenditures (10% crash reduction)
- ▶ Reduction in secondary crashes an important component of public support
- ▶ \$5M program => \$30+M crash reduction



# Using Operations Performance Measures in Decision-Making and Communication





# Short-Term Reporting– Frequency of Congestion Info

- ▶ Depends upon purpose
- ▶ Likely outlined in strategic or business plan
- ▶ Possibilities include (not exclusively):
  - ↳ Real-time
  - ↳ Monthly
  - ↳ Seasonally
  - ↳ Annually





# The Operations Performance Measurement Plan

- ▶ Fewer measures are better
  - ↳ “Measure like you mean it”
- ▶ Choose measures that are understandable to intended audience
  - ↳ Internal staff and bosses
  - ↳ General public & decision makers
- ▶ Get started now, use current data and I.T.
- ▶ Focus on known & big problems; estimate the rest



# Lessons for Plan Development: Getting Started

- ▶ Get the key people involved from the start and keep them “in the loop”
  - ↳ Includes senior-level people involved in transportation planning and programming
- ▶ Allocate plenty of time for developing consensus goals
  - ↳ Write a memo – spend 2 years implementing
  - ↳ ...or, spend 6 months gaining consensus, implement along the way





# Rolling it all together





# The Situation

- ▶ Your state DOT is attempting to use the basic underpinnings of the MAP-21 performance management requirements to construct a set of operations performance measures for a corridor. Your boss has asked you to be a team to develop a set of performance measures, the supporting analytical and data tools, and a reporting scheme.
- ▶ What is needed for a two-page quarterly report?





# Key Considerations

- ▶ What are the most important stories?
  - ↳ What do the audiences need to know?
- ▶ How do the measures connect with the likely decisions and investment options?
- ▶ What are the most important measures? (Recognizing there will be many measures).
- ▶ Where does the data come from?
- ▶ What is the “ask”? (“what they do after they hear you”)



# NCHRP & SHRP2 References

- ▶ NCHRP Web Report #97: Guide to Effective Freeway Performance Measurement
- ▶ L02 - Establishing Monitoring Programs for Travel Time Reliability
- ▶ L04 - Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools
- ▶ L05 - Incorporating Reliability Performance Measures into Transportation Planning and Programming Processes
- ▶ L35 - Local Methods for Modeling, Economic Evaluation, Justification and Use of the Value of Travel Time Reliability in Transportation Decision Making



# SHRP2 References

- ▶ L07 - Evaluation of Cost-Effectiveness of Highway Design Features
- ▶ L08 - Incorporation of Travel Time Reliability into the Highway Capacity Manual
- ▶ L17 - A Framework for Improving Travel Time Reliability
- ▶ C02 - A Systems-Based Performance Measurement Framework for Highway Capacity Decision Making
- ▶ Products pilot test - Project L38 in Washington, Minnesota, California, and Florida.
  - ↳ Reports in editing -- results are expected soon.

# Operations Performance Measures: Resources

- ▶ FHWA Operations Performance Measures Website
  - ↳ Urban Congestion Reports (quarterly and annual), Program Examples
    - ↳ [http://www.ops.fhwa.dot.gov/perf\\_measurement/index.htm](http://www.ops.fhwa.dot.gov/perf_measurement/index.htm)
- ▶ Other Sources
  - ↳ AASHTO Standing Committee on Performance Measures
  - ↳ TRB Performance Measurement Committee
  - ↳ I-95 Corridor Coalition Probe Vehicle Data Project/Performance Measures Project